SMALL NAVIGATION PROJECT

ROCKPORT HARBOR

AT

GULL COVE

MASSACHUSETTS

(ADVANCE DRAFT)

DETAILED PROJECT REPORT

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS WALTHAM, MASS.

JULY 1964

15

FILE COPY

U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASS. 02154

ADDRESS REPLY TO:
DIVISION ENGINEER

REFER TO FILE NO.

NEDED-R 1 July 1964

SUBJECT: Detailed Project Report for Small Navigation Project, Rockport Harbor at Gull Cove, Massachusetts

TO: Chief of Engineers
ATTN: ENGCW-PD
Washington, D. C.

1. In accordance with EM 1165-2-107, there is submitted for review and comment an advance draft of the subject report.

2. Responsible officials have indicated the willingness and ability of the Town of Rockport and the State of Massachusetts to meet the requirements of local cooperation as shown in Appendix "D" of this report. Since then, local officials stated by letter of 11 May 1964, that as much as the citizens wanted to vote the necessary monies to provide the Town's share of the cost of construction for this breakwater improvement, economically, the Town is unable to do so at this time. However, the citizens wanted to keep the project active, and requested a delay of one year in order to obtain the necessary legal assurances of local cooperation at the 1965 annual Town meeting. In reply, the Town was informed that compliance with the requirements of local cooperation would not be required until Federal construction funds have been allocated and it was quite probable that their proposed action at the 1965 Town meeting would be adequate as to time. In addition, that as long as the interest and the intent of the Town to prosecute the project, if approved, at an early date is indicated, this breakwater project would be retained in an active status. Formal assurances of participation will be obtained from the State and Town during preparation of the final designs for the project.

3. The plans and specifications will be prepared in accordance with the Detailed Project Report as approved. Funds in the amount of $18,500 for preparation of the plans and specifications will be required. However, the initial allotment of engineering funds should be limited to $3,500 until the Town of Rockport holds its next regular annual meeting in March 1965. The total Federal share of construction is $200,000, and the local share is currently estimated to be $260,000.

4. Formal comments of the Governor of Massachusetts will be requested after approval of the advance draft.

Incl (10 cys)
as

P. C. HYZER
Brigadier General, USA
Division Engineer

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Maps Accompanying Report:

Report Map - File No. 14F-9-3	Sheet 1 of 1
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U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
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NEDED-R

DETAILED PROJECT REPORT
ROCKPORT HARBOR, GULL COVE, MASSACHUSETTS

PERTINENT DATA

1. Purpose. - To provide additional small boat facilities at Rockport, Massachusetts by constructing a breakwater at the opening of a relatively deep bay, "Gull Cove", 3/4 miles N.W. of the existing Rockport Harbor project.

2. Location. - Project site is situated about 35 miles northeast of Boston, Massachusetts on the north side of Cape Ann.

3. Existing Project. - The existing Rockport Harbor project was adopted in 1902 and completed in 1905. It provides for rebuilding to a height of 18.5 feet above M.L.W., two breakwaters built under a previous project.

4. Improvement Desired. - A breakwater, about 600 feet long and a clear navigable entrance channel with a controlling depth of 6 feet at M.L.W. to provide safe anchorage in Gull Cove.

5. Recommended Improvement. - A breakwater about 600 feet long extending southerly from a privately constructed granite pier to Sandy Bay Ledge at the mouth of the cove, and a 6-foot deep entrance channel.

6. Estimated Costs:

Stone breakwater	$349,000
6-foot channel	0
Contingencies @ 15%	51,000
Engineering and Design	20,000
Supervision and Administration	40,000
Construction Total (April 1964)	$460,000

7. Apportionment of First Cost:

Federal:	
Corps of Engineers: 53% of $460,000	$244,000
Coast Guard: Additional Navigation Aids	1,200
TOTAL Federal	$245,200
Federal Limitation - Section 107	$200,000
Non-Federal:	
Cash Contribution: 47% of $460,000	$216,000
Excess Cost over Federal Limit	44,000
TOTAL Non-Federal Cost	$260,000

8. Annual Costs:

Federal Annual Charges:	
Corps of Engineers	
Interest & Amortization (50 yrs. at 3.0%) (0.03886 x $200,000)	$ 7,800
Coast Guard - Aids to Navigation (0.038866 x $1,200)	50
Maintenance: Breakwater	1,000
Navigation Aids	70
Total Federal Annual Charges	$ 8,920
Non-Federal Annual Charges:	
Interest & Amortization (50 yrs at 3.0%) (0.03886 of $260,000)	10,100
Total Annual Charges	$ 19,020

9. Benefits:

	General	Local	Total
Fishing Boats:	1,700	-	1,700
Recreational Boats:	16,100	14,400	28,800
	$16,100	$14,400	$30,500
	53%	47%	100%

10. Benefit Cost Ratio = 30,500/19020 = 1.6

11. Requirements of Local Cooperation:

a. Local interests should contribute in cash 47 percent of construction costs and assume all costs in excess of the $200,000 Corps of Engineer's limitation on Section 107 projects.

b. Local interests should provide, without cost to the United States, all lands, easements and rights-of-way necessary for construction and maintenance of the project when and as required. Local interests should also hold and save the United States free from damages that may result from either the construction works or maintenance, and

c. Maintain, without cost to the United States the existing public landing, known as "Granite Pier" during the life of the project with adequate access channels and berth 6 feet deep open to all on equal terms.

AUTHORITY

12. This Detailed Project Report is submitted pursuant to authority contained in Section 107 of the River and Harbor Act of 1960. An investigation of Rockport Harbor, (Gull Cove), with a view to determining whether the existing project should be modified at this time was initiated under authority of a resolution of the Committee on Public Works of the House of Representatives adopted 16 July 1958. Preliminary results of the study indicated that purpose, scope and cost of further improvement of the harbor best suited to meet the needs of navigation could meet the criteria established under the above general authority. Accordingly, by letter dated 24 January 1964, approval was requested of the Chief of Engineers to continue and complete the study under the general authority. Specific authority to prepare and submit this Detailed Project Report was provided by 1st Indorsement, dated 4 February 1964 from the Chief of Engineers.

PURPOSE AND EXTENT OF STUDY

14. Engineering and economic studies have been made to determine the need and economic justification of constructing a 600-foot breakwater for the protection of Gull Cove Harbor. A detailed hydrographic survey made in 1962, by the Commonwealth of Massachusetts was used for the purpose of estimating construction costs for the plan of improvement.

15. A public hearing was held at Rockport on 20 June 1962. Information presented at the hearing is described later in this report under "Improvement Desired". The information obtained from the public hearing has been further supplemented by recent field investigations and discussions with local interests. Available maps, past records, and other data pertaining to the harbor have been studied.

DESCRIPTION

16. Rockport Harbor, Massachusetts is situated on the east side of Cape Ann, a rocky headland which forms the southern and western limits of Sandy Bay. It is 35 miles northeast of Boston. There are three coves in the town of Rockport which serve the needs of navigation. The main cove is Rockport Harbor which is the center of boat service activity. The other coves are Pigeon Cove, 1 1/2 miles northwesterly, and Gull Cove about 1/2 mile northwesterly of Rockport Harbor. The proposed breakwater would be located at the mouth of Gull Cove. An existing granite pier is located on the north side of Gull Cove, providing about 3 acres of protected area for boats within the Cove. This pier is a rubble stone structure about 1,000 feet long. It has an average width of 300 feet and rises about 40 feet above M. L. W. It was purchased from private owners by the town of Rockport in January 1957.

17. The present entrance channel is located on the northeast side of Gull Cove between a small island, known as Sandy Bay Ledge and the mainland, with a controlling depth of 30 feet. The harbor is vulnerable to storm waves from the northeast quadrant. Mean range of tide is 8.6 feet. All depths in this report refer to the plane of mean low water as established by the United States Coast and Geodetic Survey. The location of this cove is shown on U. S. Coast & Geodetic Survey Chart No. 243, on Army Map Service quad sheet for Rockport, and on the map accompanying this report.

18. There are no bridges in the waterway.

TRIBUTARY AREA

19. The permanent populations of Essex County, the town of Rockport, and the city of Gloucester in 1960 were 568,831, 4,616, and 25,789, respectively, an increase since 1950 of 10 percent for Essex County and Rockport and about 700 people for Gloucester. The above populations are greatly augmented by seasonal residents and tourists during the summer. The town of Rockport and the surrounding region contain a large number of tourist accommodations with about 750 rooms available for rental in Rockport alone. The region is easily accessible over highways and local roads.

PRIOR REPORTS

20. Rockport Harbor has been subject to several navigation studies the first of which was made in 1830. The latest report, dated 26 January 1900, (House Document 230, 56th Congress, 1st Session) is the basis of the existing project. Gull Cove has not been subject to Federal study.

EXISTING CORPS OF ENGINEERS PROJECT

21. The existing Rockport Harbor project was authorized by River and Harbor Act of 3 March 1899. It provides for the repair of two rubblestone breakwaters at the mouth of the harbor, and for removal of the principal rocks in the harbor. Repairs consisted of reconstructing the breakwater to a top elevation of 18.5 feet. The project was adopted in 1902 and completed in 1905 at a total project cost (1900) of $22,481. There is no existing project at Gull Cove.

LOCAL COOPERATION ON EXISTING AND PRIOR PROJECTS

23. There were no requirements of local cooperation on the existing Federal project.

OTHER IMPROVEMENTS

24. Rockport Harbor has a history of improvements by the town of Rockport and the Commonwealth of Massachusetts. Through the Division of Waterways, Public Works Department, the Commonwealth of Massachusetts has contributed approximately $119,200 for improvement of Rockport Harbor. These known improvements all involved dredging within the harbor back to the year 1908. The most recent of these

projects was completed in April 1963. It involved the dredging of the inner basin of Rockport Harbor to provide a 7-foot depth. Approximately 10,500 cubic yards of material was removed at a cost of $57,000.

TERMINAL AND TRANSFER FACILITIES

25. Within the town of Rockport commercial landing facilities are available in Rockport Harbor, Gull Cove, and Pigeon Cove as follows:

a. Rockport Harbor - There are 3 wharves in Rockport Harbor. The first wharf on the north side of the harbor, known as New Wharf has a float landing. Fuel, supplies and water are available. The other two wharves form an inner basin on the north side of the harbor used by the commercial fishing and lobster fleet; one wharf is known as Old Wharf and the other T-Wharf. The T-Wharf is town-owned and has a float landing at its head with water depths of 6 feet alongside. The Sandy Bay Yacht Club maintains 3 pontoon float landings, having a total length of 120 feet, on the southeast side of the town wharf. These floats are well equipped for the service and convenience of their members and guests.

b. "Granite Pier", which forms the east side of Gull Cove was privately constructed from granite quarry rubble and blocks to provide shipping facilities for the now nearly extinct granite industry. In addition, 1,150 feet of granite block wharf space was constructed on the northerly and westerly sides of the harbor, including two stone boat ramps at the head of the Cove. Depths of water in the approaches to the wharf are adequate for small boats presently using the facility. Approximately one half of the total wharf length of 1,150 feet is privately owned and the other half is owned by the town, including the boat ramps.

c. Pigeon Cove has a bulkhead wharf around the harbor and a public float landing with water depths of 6 feet alongside. The deepest water is located on the northeast side of the cove. A foundry is at the head of the cove. Gasoline can be obtained from a service station near the head of the harbor, and provisions and some supplies can be obtained at a nearby market. A stone ramp dry at low water is at the head of the cove.

IMPROVEMENT DESIRED

29. In order to afford local interests an opportunity to express their views with respect to the improvement, a public hearing was held

at Rockport, Massachusetts on 20 June 1962. The meeting was attended by about 100 people including two selectmen, representatives of the Chamber of Commerce, officers of the Sandy Bay Yacht Club, Members of the Granite Pier Committee for navigation improvements, local businessmen, boat owners and private citizens from Rockport and nearby towns.

30. The town of Rockport had appointed a special committee to study harbor improvements and collect data. The committee presented its recommendations as the desires of local interests. The improvement this committee considered most urgent was the protection of Gull Cove by provision of a breakwater 600' long having a height of 20 feet above mean low water and an access channel 6 feet deep into the Cove. The breakwater would extend from the existing granite pier in a southerly direction to Sandy Bay Ledge. An entrance channel 6 feet deep with minimum width of 125 feet was also requested.

31. Local interests were of the opinion that rock needed for the desired breakwater extension could be obtained from the granite pier, which is presently at a height of about 40 feet above mean low water at an average width of 200 feet. The proposed plan contemplated shaving off the top, down to elevation 20 feet, for a distance of about 900 feet. Local interests felt that this would yield about 1/2 of the rock needed to construct the desired breakwater. This material would be used within the proposed breakwater's core and the balance would be supplied from the town of Rockport's quarry.

32. Local interests indicated that Gull Cove is wide open to storm waves from the northeast quadrant, resulting in rough seas which approach the harbor entrance and continue on into the harbor creating conditions unfavorable to safe anchorage. During such storms, it was claimed that boats have been swamped at their moorings and others destroyed on the rocks of the Granite Pier after being torn lose from their moorings.

33. Local interests believe that the desired breakwater would break up the seas which now enter the harbor, thereby improving the safety of the present anchorage area and protecting an addtional 7 acres of anchorage area. In addition, the improved harbor would greatly stimulate boating activity by attracting additional transient draft and by encouraging more vessels to base permanently in this complex of harbors at Rockport.

34. It was felt the increased anchorage area at Gull Cove would relieve the present congestion for fishing and recreational craft in Rockport Harbor and nearby Pigeon Cove. The resulting benefits would include, increased use by the existing and transient fleet, a decrease in storm damage to the boats, increased tax resources and increased income from the sale of supplies and expenditures for repair and storage of boats in local yards.

35. State officials were of the opinion that the State would be willing to cooperate with town officials in an improvement recommended by the Corps of Engineers. All town officials, committee members, business representatives, and most individuals that spoke at the public hearing indicated a willingness for the town to contribute a fair share of the cost of a breakwater.

36. The Department of Interior Fish and Wildlife Service by letter dated 7 February 1962 requested consideration be given to modifying the proposed breakwater design to allow public fishing from the structure.

EXISTING AND PROSPECTIVE COMMERCE

37. Fish and fish products constitute the commerce in the harbor. Two wholesale and retail companies in the harbor process and distribute the major portion of the catch. Records of total fish landings are sporadic as evidenced by the latest 5-year record as follows: (1958) 313 tons (1959) 125 tons (1960) 252 tons (1961) 12 tons (1962) 555 tons. The apparent irregularity of the records stems from the fishermen, particularly lobstermen, not reporting their catch. Local interests report that this condition has largely been rectified and that the 1962 total is more indicative of the annual average lobster landings. Lobster landings alone in 1962 accounted for 533 tons of the 555 tons reported. This represents about a $600,000 gross valuation for this commerce alone. The remaining tonnage consists of fish products. In addition, local interests report an annual average of 150 tons of ground fish landings which is valued in excess of $100,000.

VESSEL TRAFFIC

38. There are 106 fishing craft that make Rockport their home port. These fishing boats vary in length up to 45 feet with drafts up to 5 feet. The present value of these vessels is about $320,000. The traffic created by this fleet of 106 boats is estimated to average 220 round trips per boat for a total of about 23,200 round trips annually.

The United States Waterborne Commerce Statistics have reported 29,610 vessel trips for the year 1962 and charter boats are recorded as carrying 7,040 passengers for the year 1962. In addition, there are 450 permanently based recreational craft.

DIFFICULTIES ATTENDING NAVIGATION

39. The principal difficulties experienced by mariners at Rockport are concerned with hazardous anchorage conditions. Storms from the northeast quadrant result in heavy seas which harass the entire Sandy Bay coast line. As a result, boats anchor close to the head of their respective harbors in the lee of the breakwaters or seek refuge elsewhere due to the limited available safe anchorage. Local interests claim this wave action renders the Gull Cove area entirely unfit for anchorage near the entrance and exposes those vessels at anchor in the inner basin to the danger of tearing lose from their mooring and suffering severe damage by collision or grounding.

40. Local interests further claimed that although badly needed, it is impossible to maintain a public float at the Granite Pier in Gull Cove due to the heavy storm waves passing through the existing entrance channel, particularly at high tidal periods.

WATER POWER AND OTHER SPECIAL SUBJECTS

41. This investigation presents no problems pertaining to water power, flood control, pollution or related subjects. The desired improvement would have no adverse effect on wildlife or shellfish. The report of the U. S. Fish and Wildlife Service is contained in Appendix "C".

PLAN OF IMPROVEMENT

42. Three plans of improvement have been considered in this report. All are in the Gull Cove area. The first, advocated by local interests consists of building a breakwater 600 feet long, with a top elevation of 20 feet, and a top width of 20 feet, extending in a southerly direction from the existing granite pier to Sandy Bay Ledge. Local interests feel that a breakwater in this position would best serve the needs of the harbor. The breakwater would substantially reduce storm waves from the northeasterly quadrant, and would result in additional safe anchorage area. The additional anchorage would provide for increased use of recreational craft, benefits to the fishing fleet and reductions in annual boat damages.

43. The second plan considered a breakwater substantially the same as the first with the exception that the top width would be reduced from 20 feet to 10 feet. This change in design would result in a lesser amount of stone with a comparable savings in cost, while still providing full protection to the harbor. A third plan considered modification of the second plan by constructing a 10-foot wide berm at elevation +12 on the harbor side of the breakwater to accomodate sport fishermen as requested by wildlife interests. The cost of including this feature would be $50,000. Since local interests did not favor this plan, no further consideration was given to it.

44. All plans of improvement would effectively protect an additional 7 acres of anchorage against storm waves in Gull Cove. Town officials indicated by letter of 16 January 1964 that they unanimously favored accepting the second of the three considered plans. A minimum depth of 6 feet is currently available within the harbor and along the new north-south access channel. Dredging will not be needed initially.

45. Wave studies showed that all of the considered breakwaters would be effective for overall protection of the harbor from northeasterly storms. Wave studies pertinent to the effectiveness of the breakwater show that waves greater than about 2 feet in height will be eliminated from 90% of the harbor's area.

46. Design calculations and assumptions pertinent to the typical cross section for the breakwater are shown in Appendix B. Based on design wave height of 15 feet, a typical section of the breakwater results in the following dimensions:

a. Seaward side slope of 1 on 2 with a 2.0 foot berm at elevation -15, leeward side slopes 1 on 1.5 with a 2.0 foot berm at elevation -5.0 feet.

b. Top width 10 feet at elevation +20 feet.

c. 8 ton armor stone, two layers thick on seaward side.

5 ton armor stone, two layers thick on leeward side.

47. A typical cross-section of the breakwater, showing the proposed dimensions is shown on Plate 1. The dimesions of the breakwater and size of stone indicated were developed from available data on type, size direction and frequency of wave attack anticipated on the structure.

48. Field investigations were made to determine the suitability of the town's quarry, privately owned quarries and the existing granite pier, as possible sources of material for construction of the proposed breakwater extension. The town-owned Rockport quarry was found to have a sufficient supply of suitable material, with the exception of the 8 ton face stone which can be supplied from a nearby privately owned quarry. Both quarries are within 2 miles of the project site via existing haul roads. The suitability of using part of the upper portion of the granite pier as a source of ready material, as suggested by local interests will be determined during construction. If suitable and economically practical it will be utilized. No information is presently available as to the make up of the existing rock within this pier.

SHORELINE CHANGES

49. The proposed improvement would have no significant effect on adjacent shorelines.

REQUIRED AIDS TO NAVIGATION

50. The United States Coast Guard has been consulted with regard to establishing adis to navigation for the improvement under consideration. They have reported by letter dated 19 February 1964, that it will be necessary to mark the new entrance channel with two unlighted buoys estimated to cost $1,200 with an annual maintenance cost of $70.

ESTIMATE OF FIRST COSTS

51. Estimates of first costs have been prepared for two plans of improvement. These plans provide for the protection of Gull Cove by a breakwater 600 feet long.

52. Estimates of first cost for these two plans are based on price levels of April 1964 and include allowances for contingencies, engineering, design, supervision and administration. Detailed costs are shown in Appendix A. A summary of the estimated first cost for each item of the improvement are as follows:

A

PLAN OF IMPROVEMENT (PLAN I)

Stone breakwater (20' top width)	$450,000*
Engineering and Design	20,000
Supervision and Administration	45,000
Total Project Construction Costs	$515,000

*Includes 7 contingencies

Aids to Navigation (Coast Guard)	1,200
Total Project Cost (April 1964)	$516,200

B PLAN OF IMPROVEMENT (PLAN II)

Stone breakwater (10' top width)	$400,000*
Engineering and Design	20,000
Supervision and Administration	40,000
Total Project Construction Costs	$460,000
Aids to Navigation (Coast Guard)	1,200
Total Project Cost (April 1964)	$461,200

*Includes Contingencies

ESTIMATES OF ANNUAL CHARGES

53. The estimated annual charges for all plans of improvement are based on an anticipated project life of 50 years, at an interest rate of 3.0 percent for both Federal and Non-Federal investments. Non-Federal investment costs are based on an apportionment of cost among local interests in proportion to the benefits resulting from the improvement. Additional annual maintenance charges are based on replacing about 160 tons of stone annually. The computation of annual charges are detailed below.

A. 600-Foot Breakwater

Federal Annual Charges

Corps of Engineers

Interest and Amortization 0.03886 (200,000)	$7,800
Additional Annual Maintenance 160 tons @ $6.00	1,000

United States Coast Guard

Interest and Amortization 0.03886 (1,200)	50

Additional Annual Maintenance	70
Non-Federal Charges	
Interest and Amortization 0.03886 (315,000)	$12,240
Total Annual Charges	$21,160

B. 600-Foot Breakwater

Federal Annual Charges	
Corps of Engineers	
Interest and Amortization 0.03886 (200,000)	7,800
Additional Annual Maintenance 160 tons @ $6.00	1,000
United States Coast Guard	
Interest and Amortization 0.03886 (1,200)	50
Additional Annual Maintenance	70
Non-Federal Charges 0.03886 (260,000)	$10,100
Total Annual Charges	$19,020

ESTIMATES OF BENEFITS

54. Rockport Harbor includes three component areas which make up the overall harbor. These areas, Pigeon Cove, Gull Cove, and Rockport Harbor now have insufficient safe anchorage for the existing fishing and recreational fleets. Consequently, use of the harbor is restricted and the congested anchorages are the source of boat damage, particularly during storms. The improvement, by providing 7 additional acres of protected anchorage will generate both general and local benefits. General benefits will accrue from reduction in storm damage to fishing vessels and the increased use of the harbor by the existing fishing fleet. Recreational benefits, considered to be equally general and local in nature, will result from reduction of storm damage to recreational craft, increased use of the harbor by the present local and transient fleets and additions to the fleet as a result of the improvement.

55. Gull Cove is exposed to the northeast. Wave studies of the area show that waves generated from the northeast quadrant now have a direct access to the cove. Maximum waves are estimated to be

15 feet high, generated from this quadrant, and occur at least once a year. These waves at the present time pass through the existing cove entrance creating conditions unfavorable to safe anchorage. Wave studies indicate that without improvement Gull Cove Harbor has little or no protection from the severe northeast storms that attack the Sandy Bay area.

56. Specific amounts of fishing boat damage were not tendered by local interests. From information gained in conversations with local fishermen and statements made at the hearing, it is evident that annual boat damage is incurred, particularly at Gull Cove. The fishing normally is based at Rockport Harbor. However, during the recreational season some of these boats move to Gull Cove in order to make room for the recreational fleet. A large part of the annual damages to the fishing fleet is incurred in this area during sudden summer squalls. Additional damage to fishing boats in the other areas result from congested anchorage conditions, which preclude maneuvering of boats thus causing frequent collisions. Such collisions are minor but usually require repairs. On this basis, it is conservatively estimated that an annual boat damage averaging $16 per boat or $1700 for the entire fleet of 106 boats could be prevented by the utilization of the 7 acres of safe anchorage provided by the proposed breakwater. This benefit represents about 0.5 percent of the estimated $320,000 value of the existing fishing fleet. It is considered that no other commercial benefits would be derived from improvement.

57. Benefits for the recreational fleet have been evaluated as the gain in annual return which the owner of the draft would enjoy, if improvements were made. The annual net return to the owners of recreational boats has been taken as the net amount the owners would receive if they chartered their boats to others. The value of this gain is expressed as a percentage of the current market value of the fleet. The gain represents the difference between present use of the harbor and the increased use that will be made possible as a result of improvement. Ideal return varies according to the size and type of boat. For this report, the ideal return would range from 13 percent for outboards, 8 percent for the larger boats, and 14 percent for full time charter boats.

58. Benefits to be derived from the existing 150 small outboards and 150 small sail boats have been reduced by 50 percent. Local interests have indicated that this fleet uses the anchorage facilities only for limited periods of time. These 300 boats make up 68% of the entire

recreational fleet and if considered to use the presently available 19 acres of anchorage continuously would cause a density of about 30 boats per acre, thus magnifying the already over-crowded anchorage conditions. The reduced ideal percent of return for these boats is reflected in Table I.

59. Increased use of the harbor would be a primary benefit accruing from the breakwater protection. Increased use is considered to result from easing congestion in the present anchorages by allowing for the transfer of parts of the existing fleet to the new anchorage. The consensus of opinion of those who advocated this improvement is that the present boating season varies depending on the type of craft in question. Inboards, outboards, and cruisers enjoy about a 120-day season. The auxiliary sail boat season is about 180 days, and sail boats depending on size enjoy a 125 day to 200 day season. These seasons range from mid-April to the end of October. The shortened season for the smaller craft is due in part to a large number of absentee owners who do not leave their boats unattended during the early part of May and beyond mid-September, because of the high incidence of equinoctial storms with winds up to 50 and 60 miles per hour during this period. These storms usually originate in the northeast quadrant.

60. The existing locally based recreational fleet consists of 442 boats. Of these, 150 are outboards, 40 inboards, 34 cruisers, 36 auxiliary sail, 166 sailboats and 16 charter boats. Benefits from the increased use by the existing and prospective fleet have been computed. This improvement will allow full unrestricted use of the harbor for those fleets, and annual benefits have been evaluated on this basis.

61. The benefits evaluated for the present fleet are shown in Table I.

62. It is reported by local people that there are about 1200 boats visiting the harbor annually with an average stay in the harbor of about 1 day per boat. For an average 150 day transient boating season, this will amount to 1200 boat days or the equivalent of 8 permanently based boats. The benefits will amount to $800 of which $400 is considered general and $400 local. Benefits for these boats are detailed in Table II.

63. Local interests cited the congested anchorage conditions as a primary cause for the deterioration of the existing recreational fleet. It was claimed that several boat owners had left the fleet because of

ROCKPORT HARBOR
AT
HARBOR: GULL COVE

TABLE I BENEFITS TO RECREATIONAL BOATING
EXISTING FLEET

Type of Craft	Length (feet)	No. of Boats	Depreciated Value Average $	Depreciated Value Total $	Percent Return Ideal	Percent Return % of Ideal Pres.	Percent Return % of Ideal Ftr.	Gain	Value $	On Cruise Avg. Days	On Cruise % of season	Value $
Recreational Fleet												
Outboards	10-20	150	1,000	150,000	13	85	95	1.3	1950 *	see footnote	-	
Inboards	10-20	40	1,500	60,000	11	85	95	1.1	660	-	-	-
Cruisers	15-30	24	15,000	360,000	9	85	95	0.9	3240	8	7	230
	31-50	10	20,000	200,000	8	85	95	0.8	1600	5	12	190
	51-60	-										
Aux. Sail	15-30	30	9,300	280,000	9	85	95	0.9	2520	8	4	100
	31-40	4	25,000	100,000	8	85	95	0.8	800	15	8	60
	41-60	2	25,000	50,000	8	85	95	0.8	400	15	8	30
Sailboats	10-20	150	835	125,000	12	85	95	1.2	1500 *	see footnote	-	
	21-30	10	2,500	25,000	11	85	95	1.1	280	6	5	15
	31-40	6	3,000	18,000	10	85	95	1.0	180	6	5	10
	41-60											
Charter Boats												
Cruisers	21-35											
	36-50	16	6,250	100,000	14	85	95	1.4	1400	-	-	-
	51-100											
TOTALS		442		$1,468,000					14,530			$635

Total Benefits $14,530 - ($1,950 / $1,500) - $635 = $12,170 say $12,100
2

*Boats of this type would only use the anchorage facilities 50% of the boating season.

ROCKPORT HARBOR
AT
HARBOR: GULL COVE

TABLE II BENEFITS TO RECREATIONAL BOATING
TRANSIENT FLEET

Type of Craft	Length (feet)	No. of Boats	Depreciated Value Average $	Depreciated Value Total $	Percent Return Ideal	Percent Return % of Ideal Pres.	Percent Return % of Ideal Ftr.	Percent Return Gain	Value $	On Cruise Avg. Days	On Cruise % of season	On Cruise Value $
Recreational Fleet												
Outboards	10-20											
Inboards	10-20											
Cruisers	15-30 31-50 51-60	3	20,000	60,000	9	85	95	0.9	540			
Aux. Sail	15-30 31-40 41-60	1	25,000	25,000	8	85	95	0.8	200			
Sailboats	10-20	3	250	2,550	12	90	95	0.6	15			
	21-30	1	2,500	2,500	11	85	95	1.1	27			
	31-40											
	41-60											
Charter Boats												
Cruisers	21-35											
TOTALS		8	$90,000						$782			

Say Net Benefit $800/Yr.

ROCKPORT HARBOR
AT
HARBOR: GULL COVE

TABLE III BENEFITS TO RECREATIONAL BOATING
NEW FLEET

Type of Craft	Length (feet)	No. of Boats	Depreciated Value Average $	Depreciated Value Total $	Percent Return Ideal	Percent Return % of Ideal Pres.	Percent Return % of Ideal Ftr.	Gain	Value $	On Cruise Avg. Days	On Cruise % of season	On Cruise Value $
Recreational Fleet												
Outboards	10-20											
Inboards	10-20											
Cruisers	15-30	2	7,000	14,000	9	0	95	8.55	1197	8	7	84
	31-50	2	10,000	20,000	8	0	95	7.6	1520	15	12	182
	51-60											
Aux. Sail	15-30	4	5,000	20,000	9	0	95	8.55	1710	8	4	68
	31-40	4	12,000	48,000	8	0	95	7.6	3648	15	8	292
	41-60											
Sailboats	10-20	4	800	3,200	12	0	95	11.4	365	-	-	
	21-30	1	2,000	2,000	11	0	95	10.45	209	6	5	10
	31-40											
	41-60											
Charter Boats												
Cruisers	21-35											
	36-50	5	6,500	32,500	14	0	95	13.3	4323			
TOTALS		22		$139,700					$12,972			$636

Net Benefit = $12,972 - $636 = $12,336 - Say $12,300

conjested conditions. In addition, it was claimed that several summer residents were waiting for additional space in the harbor, prior to engaging in recreational boating. Also, the yacht club has indicated that it has a waiting list of potential boatowners. In view of these conditions, recreational boating is expected to increase substantially immediately after improvement. On this basis, it is conservatively estimated that the existing recreational fleet will increase by at least 5 percent or 22 boats. The composition of this fleet and the benefits to be obtained by them are shown in Table No. III. No benefits are taken for future additions to the fleet, as it is considered that the harbors potential for further increases will be small without further expansion, which is not forseeable at this time.

64. The annual benefits described above are summarized in the following Table No. IV.

TABLE IV

600' Breakwater Extension

Source	General	Local	Total
Fishing Boats: (106)			
Reduction in Storm Damage	$ 1,700	-	$ 1,700
Recreational Boats:			
Existing Fleet (422)	$ 6,050	$ 6,050	$12,100
Transient Fleet (8)	400	400	800
New Boats (22)	6,150	6,150	12,300
Reduction in Storm Damage	1,800	1,800	3,600
Totals	$16,100	$14,400	$30,500
	53%	47%	100%

COMPARISON OF BENEFITS AND COSTS

65. Comparison of the estimated annual benefits with the estimated annual carrying charges for the proposed plan of improvement results in the following benefit-cost ratio.

600-foot Breakwater

Estimated annual benefits	$30,500
Estimated annual charges	$19,020
Benefit-Cost Ratio	1.6

PROPOSED LOCAL COOPERATION

66. The benefits from improvement of Gull Cove Harbor are 47 percent local in nature. A cash contribution by local interests of 47 percent of the construction costs of the improvement would be required. Corps of Engineers expenditures toward this small navigation project under Section 107 of the 1960 River and Harbor Act are limited to $200,000. Since initial construction costs are estimated to be $460,000 local interests would be required to assume all costs in excess of this limit as required to insure that expenditure of Federal funds will result in a complete and fully effective project. Reasonable assurances of this aspect of costs were received by letter dated 16 January 1964 from the town of Rockport.

67. Local interests should provide, without cost to the United States, all lands, easements, and rights-of-way necessary for construction and maintenance of the project when and as required. Local interests should also hold and save the United States free from damages that may result from either the construction works or subsequent maintenance.

68. For projects of this type, it is usual to require that a public landing be provided open to all on equal terms. In the harbor there is an existing granite wharf suitable for public landing. However, local interests should provide assurances that the existing public landings will be adequately maintained during the life of the project and will be open to all on equal terms. Local interests have provided reasonable assurances that all the above requirements of local cooperation will be met.

APPORTIONMENT OF COSTS AMONG INTERESTS

69. Construction costs for the 600-foot proposed breakwater have been apportioned among interests in proportion to the benefits received. Since local interests have indicated that the second of two plans would meet their needs and have expressed a willingness to cooperate in the requirements of local cooperation for that plan, the apportionment of cost is made for that plan. The use of the project is primarily

in the interests of recreational navigation and the benefits are evaluated as being 53% general and 47% local. Accordingly, the apportionment of costs is as follows:

600-Foot Proposed Breakwater

Federal

Corps of Engineers: 53% of $460,000		$244,000
	Total	$244,000
Section 107 Limitation		200,000*
	Total Federal	$200,000

Non-Federal

Cash Contribution: 47% of $460,000		$216,000
Excess over $200,000		44,000*
	Total Non-Federal	$260,000

*Local interests would be responsible for all costs incurred beyond the Corps of Engineers Cost Limitation of $200,000.

COORDINATION WITH OTHER AGENCIES

70. All Federal, State and local interests having an interest in the improvement of Gull Cove Harbor were notified of the public hearing held on June 20, 1962. Officials of the Commonwealth of Massachusetts, the town of Rockport, recreational and fishing interests were consulted concerning the effects of the proposed improvement on their activities. Local interests were consulted on the study findings at a meeting held on 6 December 1963. These interests expressed approval of the proposed improvement, and their willingness to cooperate in the proposed project.

71. The United States Coast Guard was advised on the improvement under consideration, and has reported on the need and costs for aids to navigation.

72. The Regional Office of the United States Fish and Wildlife Service was also requested to comment on the plan of improvement.

Their report notes that lobster fishing in the general area would not be affected significantly and that no significant commercial fishery benefits to the lobster fleet would result from the improvement. The report recommends that provisions for sport fishing be incorporated into the breakwater to include safe walking surface on top of the structure or construction of a berm with adequate attendant access, parking and sanitary facilities. The report further states that the facilities requested will accrue to the public at large and be widespread and general and consequently should be a non reimbursable Federal cost.

73. Consideration was given to inclusion of a berm for sport fishing in a plan of improvement. This plan together with a plan without the berm was submitted to both State and local officials for comments on the adequacy of the plans for their needs. In allocating the cost of the added features for sport fishing, the cost of the on-project facilities were apportioned as 50% Federal and 50% local and the off-project facilities as 100% local. The purpose of the breakwater is to provide save anchorage for navigation. Since the benefits from the project would accrue primarily to recreational boating, the cost of the structure was apportioned in accordance with present policy for small boat harbors which assign recreational boating benefits as 50% general and 50% local. It is considered that benefits to be derived by sport fishing from the structure are equally local and general in character. Further, it is considered unreasonable to treat recreational benefits from sport fishing as entirely general when the major function of the structure is for navigation purposes and the recreational benefits anticipated to accrue to navigation from the structure are equally general and local in character.

74. In view of the probability that the estimated Federal cost of a breakwater to protect Gull Cove would exceed the Federal Limitation of $200,000 as defined in Section 107 of the 1960 River and Harbor Act, the cost of the addition of features for sport fishing would ultimately become a local responsibility. The Town of Rockport, in approving project formulation under the Section 107 program, stated a preference for a breakwater for navigation purposes only. On this basis, provision of features for sport fishing are not included in the plan of improvement at this time since means are lacking for financing this construction. It is considered, also, that the structure as proposed will permit limited benefits to sports fisheries and the resultant conditions will be conducive to later installation of safety features by local interests when the demand materializes. The report of the U. S. Fish and Wildlife Service is included in Appendix "C".

75. The Commonwealth of Massachusetts has indorsed the proposed breakwater at Gull Cove Harbor. By letter of 16 January 1964, the Town of Rockport furnished its comments on the proposed improvements. Comments by the state agency and the town of Rockport are included in Appendix "D".

SCHEDULE FOR DESIGN AND CONSTRUCTION

76. It is estimated that preparation of contract plans and specifications will require 7 months. The estimated cost is $18,500.

77. Construction of the project can be accomplished under one contract. This project consists of the construction of a breakwater about 600 feet long, requiring about 93,000 tons of stone which should take approximately 10 months to construct. Dredging will not be necessary at this time. Expenditures are as follows:

a. Allocated to date	
Detailed Project Report	$ 1,500
b. Required to Complete	
1. Plans and Specifications	18,500
2. Construction, Engineering during construction, Supervision and Administration	440,000
c. Total Project Cost	$460,000
Federal Cost	200,000
Non-Federal Cost	$260,000*

*Includes local cash contribution of $216,000 and $44,000 excess over Federal Cost Limitation of $200,000

OPERATION AND MAINTENANCE

78. Maintenance of the breakwater will be the sole responsibility of the United States. Maintenance is estimated to require replacement of about 160 tons of stone annually at a cost of $1,000.

CONCLUSION

79. In view of the present congestion of the protected anchorage in Rockport Harbor, Massachusetts, it is concluded that Federal participation in a project to provide additional protected anchorage is warranted. This protection could be best accomplished by extending

the existing granite pier in Gull Cove for a distance of 600 feet to Sandy Bay Ledge. The extension would have a top width of 10 feet and an elevation of 20 feet. A 6-foot deep channel would be maintained between the end of the breakwater and the mainland. This improvement would result in benefits to both recreational boating and fishing vessels that would yield a ratio of annual benefits to annual costs of 1.6. Local interests have provided reasonable assurances of meeting the indicated requirements of local cooperation, including all costs above the Federal Cost Limitation of $200,000, presently estimated at $260,000 (April 1964)

RECOMMENDATIONS

80. In view of the foregoing, the Division Engineer recommends that the existing project at Rockport Harbor be modified to include additional protected anchorage which would be accomplished by construction of a stone breakwater 600 feet long, top width of 10 feet, top elevation of +20.0 feet, extending in a southerly direction from the existing Granite Pier to Sandy Bay Ledge.

81. The total estimated construction cost of the recommended breakwater is $461,200, including $1,200 for additional aids to navigation.

82. This project is recommended subject to the condition that local interests:

a. Make a cash contribution currently estimated at $260,000 for the construction of this project, and under general authority of Section 107 of the 1960 River and Harbor Act agree to bear all construction costs in excess of the Federal Cost Limitation of $200,000.

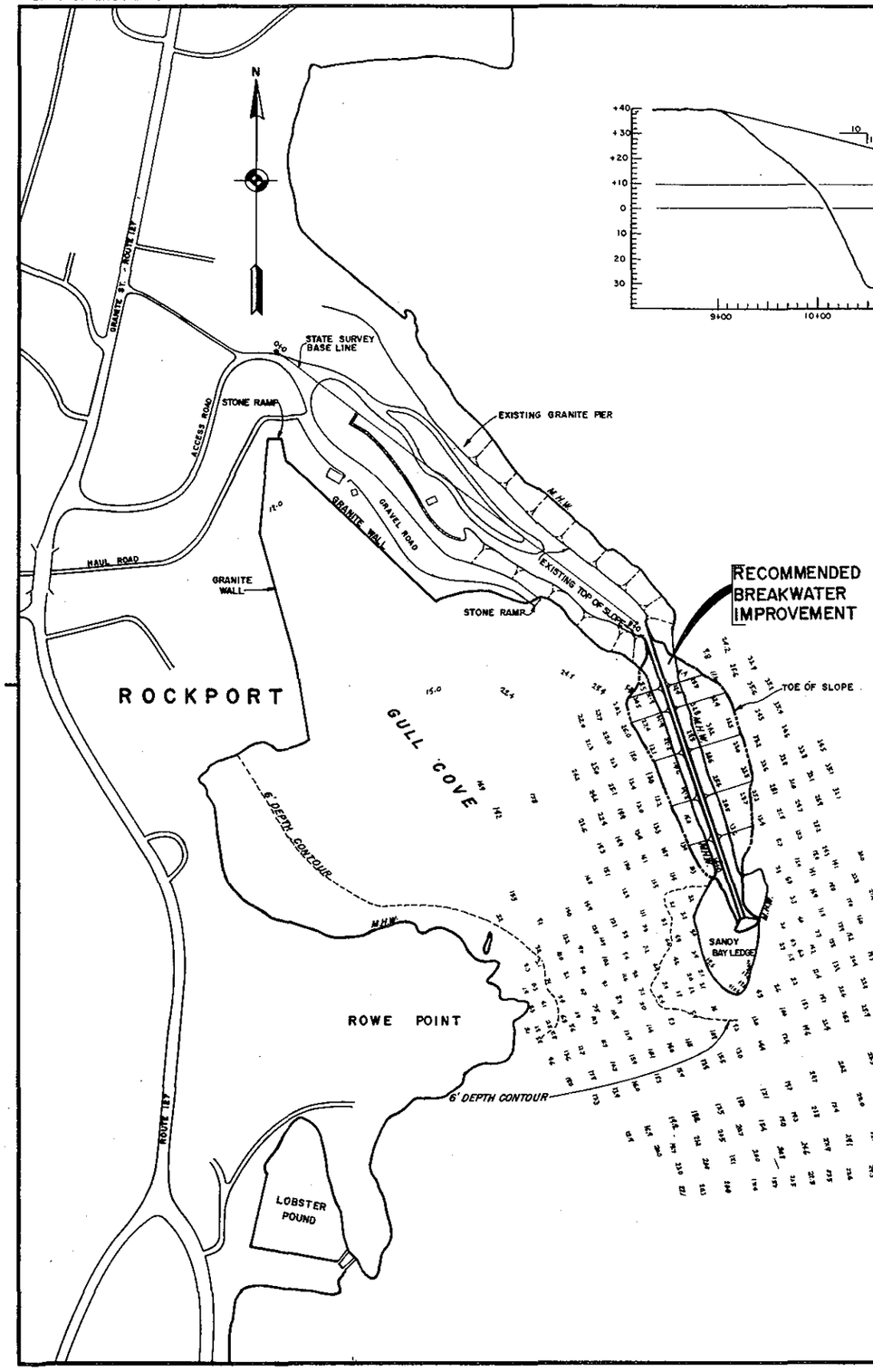
b. Provide, without cost to the United States, all lands, easements, and rights-of-way necessary for construction and maintenance of the project when and as required.

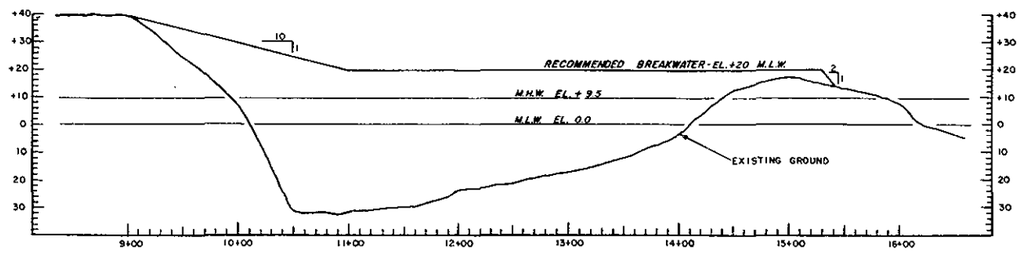
c. Hold and save the United States free from damages that may result from construction and subsequent maintenance of the project.

d. Provide assurances that the existing public landing will be adequately maintained during the life of the project and will be open to all on equal terms.

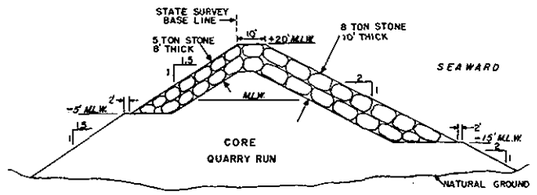
CORPS OF ENGINEERS

U. S. ARMY

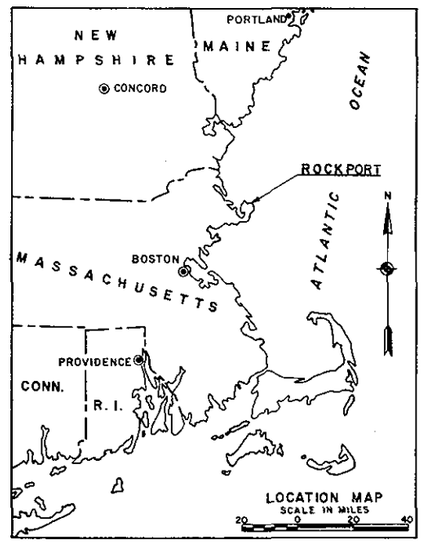


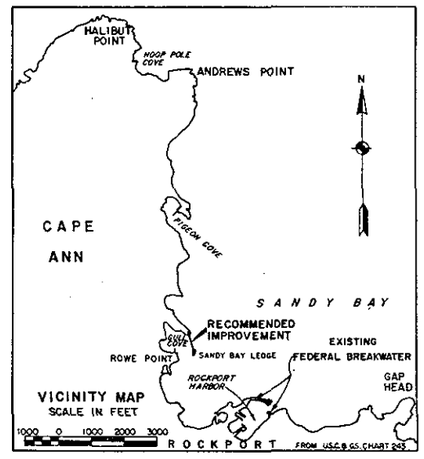


PROFILE
RUBBLE-MOUND BREAKWATER
SCALE IN FEET
HOR. 50 0 50 100
VER. 20 0 20 40



TYPICAL SECTION - 600 FOOT BREAKWATER
SCALE IN FEET
20 0 20 40





GENERAL NOTES:

Soundings are in feet and tenths and are referred to the plane of Mean Low Water.

Mean range of tide is 8.6 feet.

Soundings are based on hydrographic survey data of February 1961 by Division of Waterways, Commonwealth of Massachusetts.

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS, WALTHAM, MASS.

ROCKPORT HARBOR AT GULL COVE, MASS.

SHEET 1 OF 1 — JULY, 1964

SCALE IN FEET
100 0 100 200

APPROVED: CHIEF, ENGINEERING DIVISION

SUBMITTED: CHIEF, PLANNING AND REPORTS BRANCH

CHIEF, RIVER AND HARBOR SECTION

PROJECT ENGINEER

DR. BY: CH'K'D

TR. BY: CH'K'D

DR. BY:

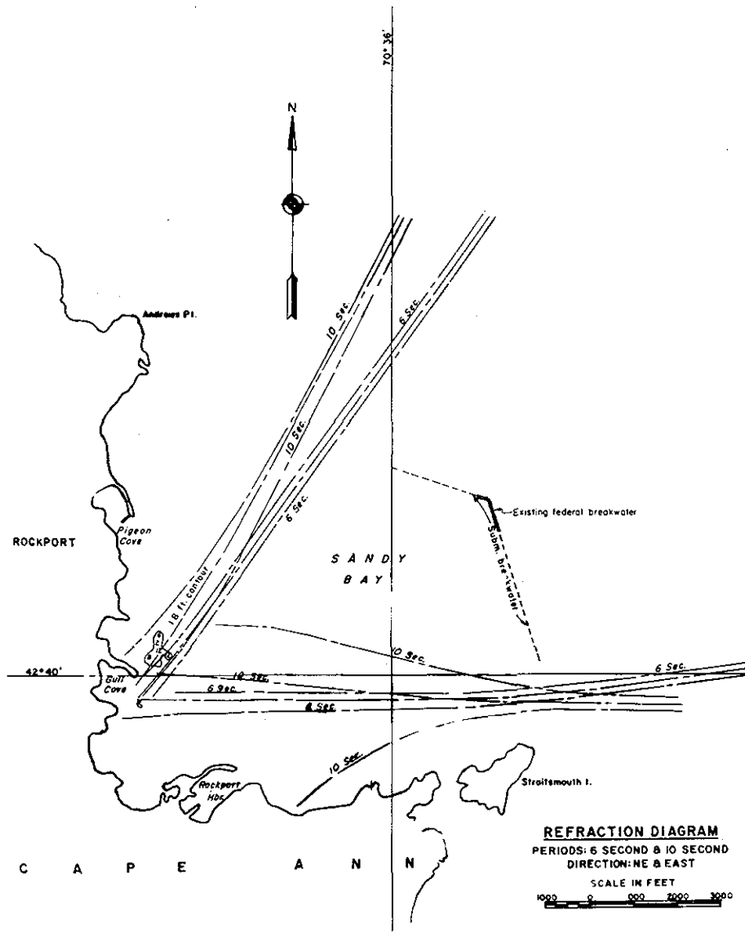
TO ACCOMPANY DETAILED PROJECT REPORT DATED JULY 1, 1964

FILE NO. 14 F-9-3

PLATE I

CORPS OF ENGINEERS

U. S. ARMY



REFRACTION DIAGRAM

PERIODS: 6 SECOND & 10 SECOND
DIRECTION: NE & EAST

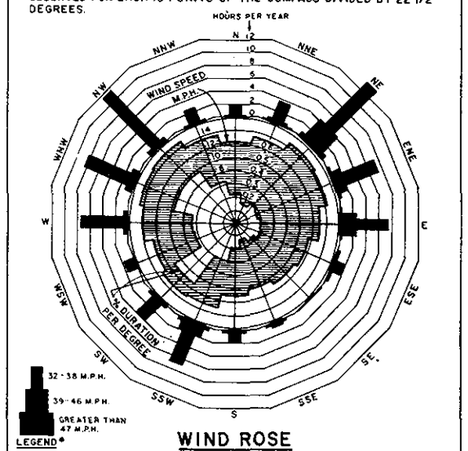
SCALE IN FEET

1000 0 1000 2000 3000

*DURATION FOR EACH RANGE OF WIND SPEEDS IS MEASURED OUTWARD FROM TOP OF UNDERLYING BAR GRAPH.

NOTE:

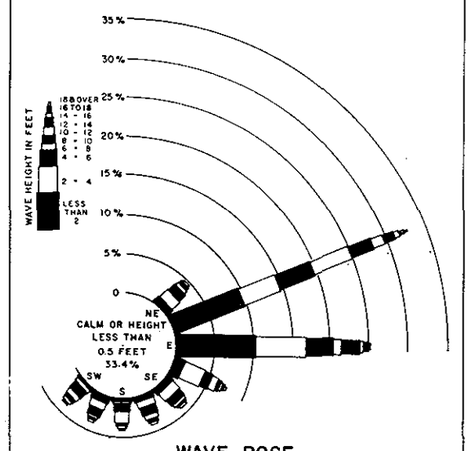
PERCENT DURATION PER DEGREE IS THE AVERAGE PERCENT DURATION OBSERVED FOR EACH 16 POINTS OF THE COMPASS DIVIDED BY 22 1/2 DEGREES.



WIND ROSE

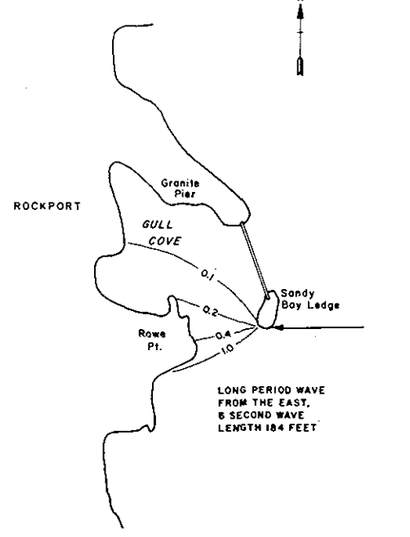
LOGAN AIRPORT, BOSTON, MASS.
OCTOBER 1949–SEPTEMBER 1959
10 YEAR RECORD

COMPOSED OF DATA OBTAINED BY HINDCAST OF 3 YEARS OF WIND RECORDS (1948-1950) SHOWING PERCENT OF TIME WAVES OF DIFFERENT HEIGHT OCCUR FROM EACH DIRECTION. FROM BEACH EROSION BOARD TECH. MEMO. NO. 55.



WAVE ROSE

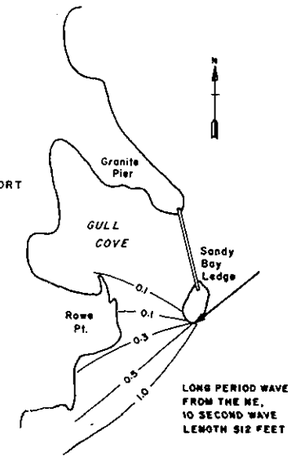
OFF NAUSET BEACH, CAPE COD, MASS.
(LAT. 41° 50' N, LONG. 69° 30' W)



DIFFRACTION DIAGRAMS

SCALE IN FEET

500 0 500 1000 1500



U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS, WALTHAM, MASS.

ROCKPORT HARBOR AT GULL COVE

SHEET 1 OF 1

WAVE DIAGRAMS

JULY 1964

APPROVED: CHIEF, ENGINEERING DIVISION		TO ACCOMPANY DETAILED PROJECT REPORT DATED: JULY 1, 1964
SUBMITTED: CHIEF, PLANNING AND REPORTS BRANCH		
CHIEF, RIVER AND HARBOR SECTION		
PROJECT ENGINEER		FILE NO. 14F-9-3

PLATE 2

GULL COVE HARBOR

APPENDIX A

ESTIMATE OF FIRST COST

1. First costs of construction for two plans of improvement are detailed below. In addition, a 10-foot wide berm on the landward side of each structure was estimated. Additional costs of the berm was estimated at $40,000 in each case. Since the berm was not included in the recommended plan of improvement its costs are not discussed further. Estimated quantities are based on an allowance of 1.5 feet for settlement and reflect prices prevailing in April (1964).

2. The detailed estimates of cost are as follows:

Project Cost Estimates
(Alternate Improvement)
(Not Recommended)

Cost Account Number	Item	Cost Estimate (x $1,000)
09	Stone:	
	8-ton face stone-23,000 tons @ $6.00	$138.0
	5-ton face stone-7,000 tons @ $4.00	28.0
	Core-quarry run stone, 75,000 tons @ $3.00 (includes 18" settlement blanket)	225.0
	Sub Total	$391.0
	Contingencies @ 15%	59.0
	Total Construction Costs	$450.0
30	Engineering and Design	20.0
	Supervision and Administration	45.0
	Corps of Engineers Total	$515.0
	Aids to Navigation (Coast Guard)	1.2
	Total Project Cost (April 1964)	$516.2

600-Foot Breakwater
(Recommended)

Cost Account Number	Item	Cost Estimate (x $1,000)
09	Stone:	
	8-ton face stone-21,000 tons @ $6.00	$126.0
	5-ton face stone-7,000 tons @ $4.00	28.0
	Core-quarry run stone-65,000 tons @ $3.00 (includes 18" settlement blanket)	195.0
	Sub Total	$349.0
	Contingencies @ 15%	51.0
	Total Construction Costs	$400.0
30	Engineering and Design	20.0
	Supervision and Administration	40.0
	Corps of Engineers Total	$460.0
	Aids to Navigation (Coast Guard)	1.2
	Total Project Cost (April 1964)	$461.2

APPENDIX B

DESIGN OF IMPROVEMENT

1. Gull Cove is exposed to storm waves generated from the northeast quadrant. The axis of the harbor is approximately N-S. Storms approaching from the northeast quadrant result in heavy seas which surge into the harbor. This wave action creates conditions unfit for anchorage and causes vessel damage at the head of the harbor. It was found that a breakwater along the east side of the harbor, as desired by local interests, to reduce storm waves would best serve the navigation needs of the town of Rockport.

2. Refraction studies relative to determining design wave heights at the mouth of the cove were made for wind generated waves approaching from the northeast quadrant with an unlimited fetch. The refraction diagrams are shown on Plate 2 attached to this report.

3. A design wave of 15 feet was determined for storms originating from the NE quadrant. Due to the irregularity of the bottom contours and an existing shoal located about 700 feet NE of the proposed structure, it was found that the orthogonal diverged to such an extent upon approaching the entrance to the harbor that a reliable refraction coefficient could not be obtained for wave periods of 10 or more seconds. However, a coefficient of 0.6 was considered reasonable for obtaining the design wave height.

4. Significant wave heights between 20 and 25 feet were obtained at deep water station off Nauset Beach, Cape Cod, Massachusetts in the years 1948 through 1950. These heights prevailed for a total of 32 hours in that period. Applying the 0.6 refraction coefficient to these significant wave heights resulted in a design wave height of 15.0 feet. Computations for a design wave height approaching the harbor based on United States Weather Bureau records at Boston which shows the duration of winds, their direction and speeds, for the period October 1949 to September 1959 revealed a maximum wave height of 15 feet. Thus, the design wave height described above is confirmed. Diffraction wave studies were made for the proposed breakwater layout to determine the effectiveness of the structure in reducing storm waves entering the harbor. It was considered that if storm waves approaching from the northeast could be reduced to about 2 feet, then no serious problem to the existing and prospective fleet using the harbor during such storms would be encountered. The studies indicated that the proposed 600-foot breakwater is effective in reducing storm waves within the major portion of the harbor to 2 feet or less.

5. Field investigation of the existing granite pier revealed that its armor stone is of about a 5-ton size, on a 1.4 slope. This slope prevails from an elevation of 5 feet above to well below mean low water. Above the 5-foot elevation the slope is about 1.1 1/2 which is probably the slope maintained throughout in original construction. Using the Waterways Experimental Station's stabilization formula (EM 1110-2-2904) it appears that the 5-ton armor stone could have been disturbed in such a manner as to result in the flatter slope.

6. For the design of the typical section of the breakwater, Waterways Experimental Station Formula was used. Based on a 15 foot design wave, 163 lbs/cu. ft. stone and a K sub delta of 5.5 and a slope of 1 on 2, it was determined that an 8-ton armor stone is required. The use of the 8 ton stone which is available in the areas, is considered to be more economical than to flatten the slope of the face of the breakwater. This consideration is based on the depths of water involved. The 1 on 2 slope would extend down to one design wave height or 15 feet below MLW. Thence for ease of construction a 2 foot berm would be placed, at -15 feet MLW. Thence the 1 on 2 slope would continue down to the bottom. The width of the crest should be at least two stones wide. Based on 8 ton stone having a width of 4 to 5 feet the crest width would be 10 feet.

7. The height of the breakwater was predicated on the run up of a long period deep water wave with an unlimited fetch, and generated from east northeast direction. It was determined that a 15 foot wave at the breakwater in the 30 foot depth of water had a wave steepness factor of 0.05. Based on a steepness factor of 0.05, a run-up factor of 0.95 was applied to the 15 foot wave. Therefore, the wave run-up would be in the order of 14 feet and when added to the still water level of 11.0 feet above mean low water results in storm run-up to an elevation of 25 feet at the proposed breakwater location.

8. It is concluded that the top elevation of the breakwater should be 20 feet above MLW for the following reasons:

a. The overtopping of the breakwater by the wave run-up of 4 to 5 feet would not have a significant effect on the wave action within the harbor.

b. The occurance of the 15-foot deep ocean wave at the breakwater at the time of spring range of tide (+ 11' MLW) would be infrequent.

c. As seen from Plate 2 the 15-foot ocean wave would approach the breakwater at an oblique angle. Thus, overtopping would occur primarily on the outer portion of the breakwater.

12. Therefore, it is concluded that consideration should be given to the 600-foot breakwater of a typical section:

a. Top elevation of 20 feet above MLW.

b. Seaward side slopes 1 on 2 and leeward side slope of 1 on 1.5 from elevation +20 feet to bottom.

c. Top width of 10 feet.

d. Two 2-foot berms; one at elevation -15 feet below MLW, on the seaward side. The other at a location -5 feet below MLW, on the leeward side.

e. Seaward - 8 ton armor stone, 2 layers thick
Leeward - 5 ton armor stone, 2 layers thick

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
59 TEMPLE PLACE
BOSTON, MASSACHUSETTS 02111

June 2, 1964

Division Engineer
New England Division
U. S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Sir:

This is our conservation and development report on the fish and wildlife resources that may be affected by navigation improvement measures being considered for Rockport, Massachusetts, under Section 107 of the 1960 River and Harbor Act. This report was prepared under authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-666 inc.), in cooperation with the Massachusetts Division of Fisheries and Game and the Division of Marine Fisheries, and has the concurrence of these agencies as indicated by letters dated May 6, 1964 and May 4, 1964, respectively. This report has been coordinated with and represents the views of the Bureau of Commercial Fisheries.

It is our understanding that a breakwater in Sandy Bay is being considered to improve Gull Cove Harbor. The breakwater, about 600 feet long, would extend from the existing granite pier to Sandy Bay Ledge. Private yachts and other recreational boats anchor in the area. The breakwater will make the anchorage safer for these boats. We understand that State and local officials in reviewing your studies showed interest in potential fisherman use of the breakwater. They feel that fishing from a berm near the mean high water mark may be preferred to fishing from the top of the breakwater.

Lobster fishing in the general area would not be significantly affected. Improvement of Gull Cove Harbor will provide no significant commercial fishery benefits to the lobster fishing fleet.

The breakwater will provide additional sport fishery opportunities if safe and easy access is provided. Recent surveys by the Massachusetts Division of Fisheries and Game revealed that shore fishing opportunities are limited in Rockport. We estimate the average annual fisherman use of the breakwater would be 8,000 fisherman days, whether fishing is provided on the top of the breakwater or on berms near the mean high water level. Although fishermen would fish from both sides of the breakwater, the majority would fish from the side facing shore. The average annual fishery benefits would be $12,000. This is based on a recreational value of $1.50 per fisherman day.

The sport fishery benefits are based on provision of a safe walking surface either on the top of the breakwater or on berms and providing access and parking facilities are included. A safe walking surface can be provided by having the stones within a 6-inch vertical variation and chinking the gaps. A safety railing would be desirable.

We estimate that parking facilities for fishermen on or near the granite pier would be needed for 20 vehicles during peak day use. Additional parking space may be needed for other visitors to the area.

Sport fishery benefits associated with the breakwater without the walkway would amount to about $3,000-$4,000 annually provided access and parking facilities are included. There would be no sport fishery value associated with the breakwater if there is no access for fishermen.

Since the above-mentioned facilities will accrue to the public at large and be widespread and general, the cost of these facilities should be a non-reimbursable Federal cost of the project.

If the breakwater is constructed, we recommend—

1. That fishermen be provided access to the breakwater.

2. That the breakwater provide a safe walking surface on the top or on berms for fishermen.

3. That safety railings be provided.

4. That parking facilities for 20 vehicles be available to fishermen at or near the existing granite pier.

5. That, if the project is recommended for Federal construction, the cost of providing access, safety railings, parking facilities, and a safe walking surface on the breakwater or berms be a non-reimbursable Federal cost of the project.

Sincerely yours,

E. E. Crawford
Acting Regional Director

APPENDIX D

The Commonwealth of Massachusetts
Department of Public Works
Division of Waterways
100 Nashua Street, Boston 02114

December 23, 1963

P. C. Hyzer, Brigadier General, U. S. A.
Division Engineer
U. S. Army Engineer Division
424 Trapelo Road,
Waltham 54, Massachusetts

Dear General Hyzer:

Reference is made to your letter of December 18, 1963 concerning the proposed extension of a breakwater in Gull Cove in Rockport Harbor.

The Division of Waterways favors the proposed project.

It is my belief that the Town of Rockport's interest would best be served by proceeding under the general authority of Section 107 of the 1960 River and Harbor Act even though the cost of local participation would be greater. In this connection plan number 1 would be advisable.

The Commonwealth would be prepared to assume one-half of the cost in excess of $200,000.00 under plan 1. However if the town financing is such that procedure under the authority of Chapter 107 of the Acts of 1960 is not possible the Commonwealth will be able to participate to the extent of one-half the cost of the local share on either plan or plan 2.

I trust that this information is sufficient at this time.

Very truly yours,

Anthony W. Spadafora

ANTHONY W. SPADAFORA
Acting Director, Division of Waterways

BOARD OF SELECTMEN

Town of Rockport

MASSACHUSETTS
TOWN OFFICE BUILDING

January 16, 1964

P. C. Hyzer, Brigadier General, U.S.A.
Division Engineer
U. S. Army Engineer Division
424 Trapelo Road
Waltham 54, Massachusetts

Dear General Hyzer:

In reply to your letter dated December 18, 1963, the Board of Selectmen first wish to thank you and the members of your engineering staff for the complete cooperation we have received regarding the Town of Rockport's petition to extend the breakwater in Gull Cove Harbor.

For your information, the Board of Selectmen unanimously voted to accept Plan #1 under Section 107 of the 1960 River and Harbor Act. In this plan the Federal Government would contribute $200,000. and the Town's share with help from the Commonwealth of Massachusetts would be $259,000. making a total of $459,000.

The 1964 Annual Town Meeting is to be held on March 2, 1964. The Selectmen have inserted the following two articles to cover this project.

Article 20: To see if the Town will vote to raise and appropriate, or transfer from available funds, or borrow by bond issue, or notes, a sum of money for the purpose of constructing a breakwater from Granite Pier to Sandy Bay Ledge, as shown on a plan entitled Gull Cove Harbor, on file at the Office of the Board of Selectmen, and to accept and use in conjunction therewith, allotments made available from the State and Federal Government.

Article 21: To see if the Town will assume liability, in the manner provided by the Federal and State Laws, for

all damages that may be incurred by the work to be performed by the Federal and State Government, for the construction of a breakwater between the Granite Pier and Sandy Bay Ledge in the Gull Cove Harbor area, and authorize the Selectmen to execute and deliver a bond of imdemnity therefor to the Federal and State Government.

We would sincerely appreciate a prompt reply if you have any suggestions for the rewording of these two articles.

Very truly yours,

BOARD OF SELECTMEN

Ernest R. Poole, Jr.

Ernest R. Poole, Jr.,
Chairman

ERP,jr./nw
cc: Anthony Spadafora